

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Bryan M. White et al. Examiner: Junghwa M. Im

Serial No.: 10/748,565 Group Art Unit: 2811

Filed: December 30, 2003 Docket: 884.864US1

For: THERMAL INTERMEDIATE APPARATUS, SYSTEMS, AND METHODS

APPEAL BRIEF UNDER 37 CFR § 41.37

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Commissioner for Patents
P.O. Box 1450
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Sir:

The Appeal Brief is presented in support of the Notice of Appeal to the Board of Patent Appeals and Interferences, filed on April 27, 2007, from the Final Rejection of claims 7-11 and 17-25 of the above-identified application, as set forth in the Final Office Action mailed on December 11, 2006.

The Commissioner of Patents and Trademarks is hereby authorized to charge Deposit Account No. 19-0743 in the amount of \$500.00 which represents the requisite fee set forth in 37 C.F.R. § 41.20(b)(2). The Appellant respectfully requests consideration and reversal of the Examiner's rejections of pending claims.

APPEAL BRIEF UNDER 37 C.F.R. § 41.37

TABLE OF CONTENTS

	<u>Page</u>
<u>1. REAL PARTY IN INTEREST</u>	2
<u>2. RELATED APPEALS AND INTERFERENCES</u>	3
<u>3. STATUS OF THE CLAIMS</u>	4
<u>4. STATUS OF AMENDMENTS</u>	5
<u>5. SUMMARY OF CLAIMED SUBJECT MATTER</u>	6
<u>6. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL</u>	8
<u>7. ARGUMENT</u>	9
<u>8. SUMMARY</u>	15
<u>CLAIMS APPENDIX</u>	16
<u>EVIDENCE APPENDIX</u>	19
<u>RELATED PROCEEDINGS APPENDIX</u>	20

1. REAL PARTY IN INTEREST

The real party in interest of the above-captioned patent application is the assignee,
INTEL CORPORATION.

2. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to Appellant that will have a bearing on the Board's decision in the present appeal.

3. STATUS OF THE CLAIMS

The present application was filed on December 31, 2003 with claims 1-30. A first non-final Office Action was mailed November 2, 2005. A second non-final Office Action mailed May 16, 2006. A Final Office Action (hereinafter “the Final Office Action”) was mailed November 30, 2006. Claims 1-6, 12-16, and 26-30 were canceled. Claims 7-11 and 17-25 stand triply rejected, remain pending, and are the subject of the present Appeal.

4. STATUS OF AMENDMENTS

No amendments have been made subsequent to the Final Office Action dated November 30, 2006.

5. SUMMARY OF CLAIMED SUBJECT MATTER

Some aspects of the present inventive subject matter include, but are not limited to, integrated circuit packages, computing systems, and fabrication methods thereof for transmitting heat from a circuit to a heat sink. This summary does not provide an exhaustive or exclusive view of the present subject matter, and Appellant refers to the appended claims and its legal equivalents for a complete statement of the invention.

Independent Claim 7:

Claim 7 recites an integrated circuit package (e.g., see 10 in Fig. 1) for transmitting heat from a circuit (e.g., see 20 in Fig. 1) to a heat sink. The recited integrated circuit package includes (e.g., see Fig. 1, pg. 2, ln. 11 - pg. 4, ln. 5, and Fig. 5):

a die (e.g., see 14 in Fig. 1, pg. 2, ln. 11-15);

a heat sink (e.g., see 16 in Fig. 1, pg. 2, ln. 11-15), wherein both an upper surface of the die and a lower surface of the heat sink have metal coatings of gold (e.g., see Fig. 5, pg. 3, ln. 12-16);

a first thermal intermediate portion (e.g., see 24B in Fig. 5, pg. 6, ln. 1-11) comprising a plurality of carbon nanotubes, some nanotubes of which have organic moieties attached to one end thereof (e.g., see pg. 3, ln. 21 - pg. 4, ln. 5), the one end of some nanotubes chemically bonded to the heat sink; and

a second thermal intermediate portion (e.g., see 24A in Fig. 5, pg. 6, ln. 1-11) comprising a plurality of carbon nanotubes, some nanotubes of which have organic moieties attached to one end thereof (e.g., see pg. 3, ln. 21 - pg. 4, ln. 5), the one end of some nanotubes chemically bonded to the die.

Independent Claim 17:

Claim 17 recites a computing system (e.g., see 800 in Fig. 8) for transmitting heat from a circuit to a heat sink (e.g., see Fig. 1, ln. 11 of pg. 2 - ln. 5 of pg. 4). The system includes:

at least one dynamic random access memory device (e.g., see Fig. 8, pg. 7, ln. 13-16);

a die having a circuit thereon to couple to the memory device (e.g., see 14 in Fig. 1, pg. 2, ln. 11-15);

a heat sink (e.g., see Fig. 5, pg. 3, ln. 12-16), wherein both an upper surface of the die and a lower surface of the heat sink have metal coatings of gold (e.g., see Fig. 5, pg. 3, ln. 12-16);

a first thermal intermediate portion (e.g., see 24B in Fig. 5, pg. 6, ln. 1-11) comprising a plurality of carbon nanotubes, some nanotubes of which have organic moieties attached to one end thereof (e.g., see pg. 3, ln. 21 - pg. 4, ln. 5), the one end of some nanotubes chemically bonded to the heat sink; and

a second thermal intermediate portion (e.g., see 24A in Fig. 5, pg. 6, ln. 1-11) comprising a plurality of carbon nanotubes, some nanotubes of which have organic moieties attached to one end thereof (e.g., see pg. 3, ln. 21 - pg. 4, ln. 5), the one end of some nanotubes chemically bonded to the die.

Independent Claim 22:

Claim 22 recites a fabrication process (e.g., see 600 in Fig. 6) of apparatus for transmitting heat from a circuit to a heat sink (e.g., see Fig. 6, pg. 6, ln. 12 - 24, and Fig. 7, pg. 6, ln. 25-27). The process includes:

coating at least one surface of at least one of a heat sink and of a die with a metal (e.g., see 621 in Fig. 6, pg. 6, ln. 13-14);

oxidizing carbon nanotubes ropes in sulfuric and nitric acids, whereby the carbon nanotubes ropes are cut into a plurality of short carbon nanotubes with open ends having carboxyl linkages attached thereto (e.g., see 723 in Fig. 7, pg. 6, ln. 25-27);

treating at least one end of at least some of a plurality of carbon nanotubes by applying organic moieties thereto (e.g., see 623 in Fig. 6, pg. 6, ln. 14-16); and

tethering one end of the at least some of the carbon nanotubes of the plurality of carbon nanotubes to the metal (e.g., see 629 in Fig. 6, pg. 6, ln. 23-24).

6. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

§103 Rejection of the Claims

Claims 7-11 and 17-21 were rejected under 35 USC § 103(a) as unpatentable over Dangelo et al. (U.S. 7,109,581, hereinafter “Dangelo”) in view of Uang et al. (U.S. 6,989,325, hereinafter “Uang”) and Brown et al. (U.S. 6,340,822, hereinafter “Brown”).

Claims 22-25 were rejected under 35 USC § 103(a) as unpatentable over Dangelo in view of Uang, Brown, and Yoshida (U.S. 4,169,911, hereinafter “Yoshida”).

Appellant respectfully requests reconsideration and reversal of these rejections.

7. ARGUMENT

Rejection Under 35 U.S.C. §103

Claims 7-11 and 17-21 were rejected under 35 USC § 103(a) as unpatentable over Dangelo in view of Uang and Brown.

Claims 22-25 were rejected under 35 USC § 103(a) as unpatentable over Dangelo in view of Uang, Brown, and Yoshida.

A) The Applicable Law under 35 U.S.C. §103

In rejecting claims under 35 U.S.C. §103, the examiner bears the initial burden of factually supporting any *prima facie* conclusion of obviousness. See M.P.E.P. §2142.

In the recent decision of the Supreme Court on *KSR Int'l Co. v. Teleflex Inc.*¹, the analysis of obviousness previously set forth in *Graham v. John Deere Co. of Kansas City*², was reaffirmed. The Court in *Graham* set out an objective analysis for applying §103 as follows:

"Under §103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background the obviousness or nonobviousness of the subject matter is determined."³

To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).

Therefore, the test for obviousness under §103 must take into consideration the invention as a whole; that is, one must consider the particular problem solved by the combination of elements that define the invention. *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 1143, 227 USPQ 543, 551 (Fed. Cir.1985). The Examiner must, as one of the inquiries pertinent to any

1 127 S.Ct. 1727, 82 USPQ.2d 1385 (2007)

2 383 U.S. 1, 17, 86 S.Ct. 684, 15 L.Ed.2d 545 (1966)

3 The Court in *KSR v. Teleflex*, at page 1730, quoted the analysis of *Graham* from page 18.

obviousness inquiry under 35 U.S.C. §103, recognize and consider not only the similarities but also the critical differences between the claimed invention and the prior art. *In re Bond*, 910 F.2d 831, 834, 15 USPQ2d 1566, 1568 (Fed. Cir. 1990), *reh'g denied*, 1990 U.S. App. LEXIS 19971 (Fed. Cir.1990). The fact that a reference teaches away from a claimed invention is highly probative that the reference would not have rendered the claimed invention obvious to one of ordinary skill in the art. *Stranco Inc. v. Atlantes Chemical Systems, Inc.*, 15 USPQ2d 1704, 1713 (Tex. 1990). When the prior art teaches away from combining certain known elements, discovery of a successful means of combining them is more likely to be nonobvious. *Id.* p. 4 citing *United States v. Adams*, 383 U.S. 39, 51-51 (1966). Additionally, critical differences in the prior art must be recognized (when attempting to combine references). *In re Bond*, 910 F.2d 831, 834, 15 USPQ2d 1566, 1568 (Fed. Cir. 1990), *reh'g denied*, 1990 U.S. App. LEXIS 19971 (Fed. Cir.1990).

B) Claims 7-11 and 17-21 were rejected under 35 USC § 103(a) as unpatentable over Dangelo in view of Uang and Brown.

Because, even in combination, Dangelo, Uang and Brown do not teach or suggest each and every element of the rejected claims, the Final Office Action failed to make a *prima facie* showing of obviousness of the rejected claims.

Discussion of Independent Claim 7:

Claim 7 recites as follows (with emphasis added):

7. An integrated circuit package, comprising
a die;
a heat sink, wherein **both an upper surface of the die and a lower surface of the heat sink have metal coatings of gold;** and
a first thermal intermediate portion comprising a plurality of carbon nanotubes, **some nanotubes of which have organic moieties attached to one end thereof, the one end of some nanotubes chemically bonded to the heat sink;** and
a second thermal intermediate portion comprising a plurality of carbon nanotubes, **some nanotubes of which have organic moieties attached to one end thereof, the one end of some nanotubes chemically bonded to the die.**
(Emphasis added)

Appellant respectfully submits that, even in combination, Dangelo, Uang and Brown do not teach or suggest each and every element of the rejected claim 7 for the reasons stated below. The Final Office Action concedes that the combination of Dangelo and Uang fails to show a first and a second thermal intermediate portions as recited in claim 7.

Appellant submits that Dangelo teaches away from a feature “both an upper surface of the die and a lower surface of the heat sink have metal coatings of gold” as recited in claim 7. Dangelo does not show or suggest using a gold coating—it suggests the use of eutectic metal bonding and use of a metal catalyst layer from a closed group of materials that does not include gold:

Referring to col. 5, ln. 46-52 of Dangelo,

“An additional (optional) bonding layer 406 can be added, if **eutectic metal bonding** between chip 402 and layer 408 is desired. In this case, the exposed nanotube ends would protrude into this layer and may extend through it. Preferably, **bonding layer 406 is a eutectic metal**, but thermal polymer based bonding compounds may also be used.”

(Emphasis added)

Referring to col. 5, ln. 58-62 of Dangelo,

“Metal catalyst layer 410 is used to initiate and control growth of the nanotubes in layer 408. **Metal catalyst layer 410 may chosen from among Ti, Co, Cr, Pt, Ni and their alloys.** Preferably, metal catalyst layer 410 are Ni and Ni alloys.”

(Emphasis added)

The Final Office Action concedes that Dangelo fails to show a coating of gold on both of the die and the heat sink as recited in claim 7, but asserts that Uang discloses coating both of the die and the heat sink and it would be obvious to one of ordinary skill in the art to incorporate such teachings of Uang into Dangelo. Appellant disagrees with this assertion because, as shown above, Dangelo teaches away from using gold as coating material on the heat sink and the die. For at least this reason, Appellant respectfully submits that the §103 rejection of independent claim 7 is improper.

Appellant respectfully requests reconsideration and reversal of the §103 rejection of independent claim 7.

Discussion of Independent Claim 17:

Because independent claim 17 has substantially similar limitations to independent claim 7, the arguments applicable to independent claim 7 also apply to independent claim 17. Thus, Appellant submits that, even in combination, Dangelo, Uang and Brown do not teach or suggest each and every element of the rejected claim 17, and Appellant submits that, for the reasons stated above, Dangelo teaches away from combining its teachings with the other cited patents to provide a coating of gold on both of the die and the heat sink in the manner specified in claim 17.

Accordingly, Appellant respectfully requests reconsideration and reversal of the §103 rejection of independent claim 17.

Discussion of Dependent Claims 8-11 and 18-21:

A dependent claim is deemed to include all the elements of an independent claim from which it depends. Claims 8-11 and 18-21 each depend, directly or indirectly, on independent claims 7 or 17. For at least the reasons discussed above for the independent claims 7 and 17, Appellant submits that, even in combination, Dangelo, Uang and Brown do not teach or suggest each and every element of each of these dependent claims, and Appellant submits that Dangelo teaches away from combining Uang to provide a coating of gold on both of the die and the heat sink.

Accordingly, Appellant respectfully requests reconsideration and reversal of the §103 rejection of the dependent claims 8-11 and 18-21.

C) Claims 22-25 were rejected under 35 USC § 103(a) as unpatentable over Dangelo in view of Uang, Brown and Yoshida.

Because, even in combination, Dangelo, Uang, Brown and Yoshida do not teach or suggest each and every element of the rejected claims, the Final Office Action failed to make a *prima facie* showing of obviousness of the rejected claims.

Discussion of Independent Claim 22:

Claim 22 recites as follows (with emphasis added):

22. A process:

coating at least one surface of least one of a heat sink and of a die with a metal;
oxidizing carbon nanotubes ropes in sulfuric and nitric acids, whereby the carbon nanotubes ropes are cut into a plurality of short carbon nanotubes with open ends having carboxyl linkages attached thereto;
treating at least one end of at least some of a plurality of carbon nanotubes by applying organic moieties thereto; and
tethering one end of the at least some of the carbon nanotubes of the plurality of carbon nanotubes to the metal.
(Emphasis added)

The Final Office Action contends that the Uang, Brown and Yopshida combination shows all of what is claimed in claim 22 with the exception of showing that the nanotube ropes are cut. Although the Final Office Action asserts that “Yoshida shows that the nanotubes are cut (col. 4, lines 27-29)” Appellant notes that, Yoshida fails to show the following feature of claim 22:

“oxidizing carbon nanotubes ropes in sulfuric and nitric acids, whereby the carbon nanotubes ropes are cut into a plurality of short carbon nanotubes with open ends having carboxyl linkages attached thereto”

Because none of the cited Dangelo, Uang and Brown patents discloses an oxidizing step as recited in claim 22, Appellant submits that, even in combination, Dangelo, Uang, Brown and Yoshida neither teach nor suggest each and every element of the rejected independent claim 22. Accordingly, the Final Office Action failed to make a *prima facie* showing of obviousness of rejected claim 22.

Appellant respectfully requests reconsideration and reversal of the §103 rejection of independent claim 22.

Discussion of Dependent Claims 23-25:

A dependent claim is deemed to include all the elements of an independent claim from which it depends. Claims 23-25 depend, directly or indirectly, on independent claim 22. For at least the reasons discussed above for the independent claim 22, Appellant submits that, even in combination, Dangelo, Uang, Brown and Yoshida do not teach or suggest each and every

element of the rejected dependent claims. Accordingly, the Final Office Action failed to make a *prima facie* showing of obviousness of the rejected dependent claims.

Accordingly, Appellant respectfully requests reconsideration and reversal of the §103 rejection of these dependent claims.

8. SUMMARY

For at least the reasons argued above, claims 7-11 and 17-21 were not properly rejected under 35 U.S.C. 103(a) as being unpatentable over Dangelo in view of Uang and Brown, and claims 22-25 were not properly rejected under 35 U.S.C. 103(a) as being unpatentable over Dangelo in view of Uang, Brown and Yoshida.

Therefore, it is respectfully submitted that the art cited does not render the pending claims obvious and that these pending claims are patentable over the cited art. Reversal of the rejection and allowance of these pending claims is respectfully requested.

Respectfully submitted,

BRYAN M. WHITE et al.

By their Representatives,

SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A.

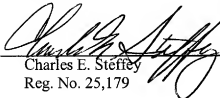
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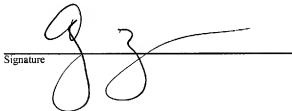

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Name

Amy Moriarty

Signature



CLAIMS APPENDIX

7. An integrated circuit package, comprising
a die;
a heat sink, wherein both an upper surface of the die and a lower surface of the heat sink have metal coatings of gold; and
a first thermal intermediate portion comprising a plurality of carbon nanotubes, some nanotubes of which have organic moieties attached to one end thereof, the one end of some nanotubes chemically bonded to the heat sink; and
a second thermal intermediate portion comprising a plurality of carbon nanotubes, some nanotubes of which have organic moieties attached to one end thereof, the one end of some nanotubes chemically bonded to the die.
8. The package of claim 7, wherein the organic moieties of the first thermal intermediate portion and the organic moieties of the second thermal intermediate portion include amide linkers.
9. The package of claim 7, wherein the organic moieties of the first intermediate portion and the organic moieties of the second intermediate portion include thiol linkers.
10. The package of claim 7, wherein the organic moieties of the first intermediate portion and the organic moieties of the second intermediate portion include thiol linkers and amide linkers.
11. The package of claim 10, wherein the carbon nanotubes of the thermal intermediate portions are generally perpendicular to the upper surface of the die or the lower surface of the heat sink.
17. A computing system, comprising:
at least one dynamic random access memory device;

a die having a circuit thereon to couple to the memory device;
a heat sink, wherein both an upper surface of the die and a lower surface of the heat sink have metal coatings of gold;

a first thermal intermediate portion comprising a plurality of carbon nanotubes, some nanotubes of which have organic moieties attached to one end thereof, the one end of some nanotubes chemically bonded to the heat sink; and

a second thermal intermediate portion comprising a plurality of carbon nanotubes, some nanotubes of which have organic moieties attached to one end thereof, the one end of some nanotubes chemically bonded to the die.

18. The system of claim 17, wherein the circuit comprises a processor that acts upon data signals.

19. The system of claim 17, wherein the organic moieties comprise amide linkers.

20. The system of claim 17 wherein the organic moieties comprise thiol linkers.

21. The system of claim 17, wherein the organic moieties comprise amide linkers and thiol linkers.

22. A process:

coating at least one surface of least one of a heat sink and of a die with a metal;
oxidizing carbon nanotubes ropes in sulfuric and nitric acids, whereby the carbon nanotubes ropes are cut into a plurality of short carbon nanotubes with open ends having carboxyl linkages attached thereto;

treating at least one end of at least some of a plurality of carbon nanotubes by applying organic moieties thereto; and

tethering one end of the at least some of the carbon nanotubes of the plurality of carbon nanotubes to the metal.

23. The process of claim 22 wherein the metal is selected from the group consisting of gold and gold alloys.
24. The process of claim 23, wherein the treating the at least one end of some of the plurality of nanotubes comprises forming an amide based linkage thereon.
25. The process of claim 23, wherein the treating the at least one end of some of the plurality of nanotubes comprises forming an amide based linkage and a thiol based linkage thereon.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.